A Role for Unmanned Aerial Vehicles on the Modern Tactical Battlefield

A Monograph
by

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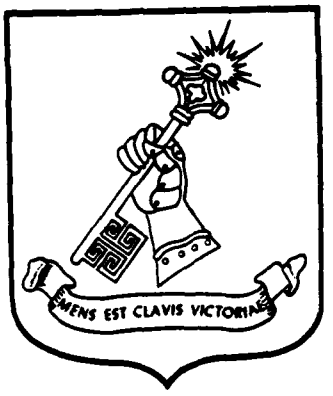

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This monograph proposes the use of close and short range unmanned aerial vehicles (UAVs) as a valuable air reconnaissance asset that is needed on the tactical battlefield. Current intelligence gathering assets at division and below don't have the range to gather information throughout the commander's entire area of operation. This is still the case when augmented by corps assets. Air reconnaissance provided by higher level can cover the area, but the response time is inadequate at the tactical level. To solve this, a UAV company is needed at division level. Keywords:

The monograph first examines two historical cases of UAV use; U.S. use in Vietnam between 1969 and 1982 and Israeli use in Lebanon's Bekaa Valley in 1982. Then, the current status of UAVs in the U.S. military is discussed, including a brief description of the Joint UAV program created by Contress in 1988. Next, the monograph addresses the intelligence needs of the tactical commander and identifies shortfalls that exist within the current force structure.

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ABSTRACT

A ROLE FOR UNMANNED AERIAL VEHICLES ON THE MODERN TACTICAL BATTLEFIELD by MAJ Lennie O. Edwards, Jr., USAF, 44 pages.

This monograph proposes the use of close and short range unmanned aerial vehicles (UAVs) as a valuable air reconnaissance asset that is needed on the tactical battlefield. Current intelligence gathering assets at division and below don't have the range to gather information throughout the commander's entire area of operation. This is still the case when augmented by corps assets. Air reconnaissance provided by higher level can cover the area, but the response time is inadequate at the tactical level. To solve this, a UAV company is needed at division level.

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I. Introduction

On the afternoon of June 9, 1982, Israel attacked Syrian surface-to-air missile (SAM) sites in Lebanon's Bekaa Valley with a coordinated attack that depended on unmanned aircraft for success. Remotely piloted vehicles (RPVs) were used effectively, demonstrating an expanded role for them on the modern battlefield. A system that had, in recent years, received little emphasis around the world was suddenly a significant factor contributing to Israel's tactical and operational success. RPVs had provided much of the necessary intelligence to launch an overwhelmingly successful air strike. They had also played a significant role in the actual attack.

In any military operation, accurate battlefield intelligence is critical to the defeat of the enemy at every level of command. Accurate knowledge of enemy positions prior to battle and the ability to detect enemy movement during a battle are helpful in determining and implementing the friendly scheme of maneuver. However, the information must not only be

accurate, it must be available to the commander in time to influence his decisions. This includes decisions reached in the planning of the battle as well as in the execution.

During the planning, the commander relies on the intelligence preparation of the battlefield (IPB) process to help shape his concept of the operation. Within this process, the doctrinal template is updated with current intelligence of the enemy order of battle to help produce the situational template.1 Information gained through air reconnaissance on the enemy order of battle can significantly enhance the accuracy of the situational template.

In addition, air reconnaissance efforts provide updates that give the commander flexibility as the battle progresses. However, tactical air reconnaissance in suport of Army operations is an Air Force mission. The Air Force assets that fly tactical air reconnaissance missions are allocated by the theater air component commander based on the tactical surveillance and reconnaissance air apportionment decision made by the joint force commander. Potential targets are recommended through the intermediate levels up to the Tactical Air Control Center at theater

level.2 Coming from such a high level, these assets are not sufficiently responsive to the information needs of the lower levels of tactical command.

There is a definite need for maneuver commanders at the tactical level to have near real-time intelligence. Division, brigade, and battalion commanders need the information that an unmanned aerial vehicle (UAV) unit could provide in order to maintain the necessary flexibility on the battlefield. The aim of this monograph is to present a case for a UAV unit in the Army force structure at division level. It could then be placed in support of operations down to the battalion level.

In order to develop the subject matter it is necessary to define several related terms. These and other terms are often interchanged in articles about unmanned aerial vehicles. To maintain consistency, only the following definitions will be used in this work.

> Automatically Piloted Vehicle (APV) - An aerial vehicle controlled by instructions stored on-board the vehicle and executed automatically.3

Drone - A land, sea, or air vehicle that is remotely or automatically controlled.4

Remotely Piloted Vehicle (RPV) - An unmanned air vehicle capable of being controlled by a person from a distant location through a communications link. It is normally designed to be recoverable.5

Unmanned Aerial Vehicle (UAV) - A term that includes unmanned aerial vehicles that are either remotely piloted or automatically piloted.6

II. Recent Historical Use of UAVs

Within the context of these definitions, this analysis will focus on reconnaissance needs at the tactical level from division to battalion size units. Historical uses of UAVs may transcend the tactical level, but they provide an appreciation for current and future applications of UAVs on the modern battlefield.

Between 1969 and 1972 the United States conducted a major tactical air reconnaissance operation using UAVs under the code name "Buffalo Hunter."7 This operation was conceived after North Vietnam significantly increased its air defense capabilities in the late 1960's. There remained the requirement for

reconnaissance flights over North Vietnam, but "Buffalo Hunter" provided a means that would not expose manned systems. Specific requirements included photographs of selected air targets, bomb damage assessment after air attack, and searches for unknown targets. An item in the Air Force inventory, the BQM-34 target drone, was modified as the main vehicle to fulfill this requirement. Normally, it was air-launched from a C-130 aircraft and recovered in flight by a helicopter.8

In all, more then 3000 missions were flown under "Buffalo Hunter." However, an accurate assessment of the success of the program is difficult. Overall attrition of the vehicles from both hostile and non-hostile causes was low at about 10 percent during the operation. Yet, the target coverage rate was an apparently low 40.5%. This means less than half of the targets against which a UAV was launched were actually found. Also, other targets were found but could not be positively located from the data obtained by the UAV. The main reason for this was the UAV's navigation system. It was not accurate enough to ensure precise tracking. This made it difficult to reconstruct the flight profile and pinpoint targets. In all, 23

percent of the target losses were attributable to navigation error. So, even when the first surface-to-air missle (SAM-2) site was photographed its location could not be accurately plotted.9

Although the success rate may seem low by today's standards, valuable information was gained. One of the primary benefits of "Buffalo Hunter" may have been the savings in reconnaissance pilots and aircraft because they did not have to fly these missions. According to Dr. John Lucas, Under Secretary of the Air Force: "The successful development of drones for aerial photography had added significantly to our reconnaissance and surveillance capability."10

UAVs drew renewed world interest after Israel attacked into Lebanon's Bekaa Valley in 1982 during Operation Peace for Galilee. Israel attacked with full knowledge of the location of all Syria surface-to-air missile sites.11 During the year prior to Operation Peace for Galilee, Israel had photographed all Syrian SAM-6 locations in the Bekaa Valley.12 Syria was using Soviet-built SAM's to project an air umbrella into Lebanon. This concept had worked well for Egypt during the 1973 Arab-Israeli conflict when Egypt had virtually denied Israeli Air Force flights near the Suez Canal by

integrating a strong air defense umbrella. However, by 1982, Israel had acquired two operational UAV systems.

UAV's were used in at least two additional roles in Operation Peace for Galilee. Besides the photo reconnaissance of Syrian SAM sites, the UAVs were used for deception during the main raid on the sites and for surveillance. In the role of deception, UAVs emitting false signals representing actual aircraft were flown into the SAM areas. When the SAM sites began tracking the UAVs, the information on type SAM and position was relayed to an aircraft orbiting some distance away. Other UAVs flew over the SAMs to jam and confuse the operators as Israeli aircraft were attacking the sites.13

In the surveillance role, Israel positioned UAVs over three major airfields inside Syrian territory to monitor airfield activity. This information was relayed to a command aircraft. When Syrian aircraft were launched, Israeli aircraft were sent to intercept and destroy them. This effort was instrumental in allowing Israeli ground forces to maintain the tempo of their attack in the east.14

The missions of reconnaissance, deception, and surveillance were all flown by the same model UAV

appropriately nicknamed the "Scout." Internal electronic components were changed based on the particular mission to be flown. The typical Israeli UAV unit contained four to six Scouts, a ground control station, and launch and recovery equipment.15

The combined results of the integrated command, control, communications, and intelligence system used by the Israelis were spectacular: Eighty-seven Syrian aircraft were destroyed with only one loss for the Israelis and eighteen SAM batterys were destroyed using the full spectrum of electronic warfare. The Israelis effectively employed electronic combat in the form of electronic countermeasures (jamming and deception) and electronic warfare support measures (surveillance and radio relay) to give direct control to the operational commander. This information formed the basis for tactical decisions on the battlefield.16

Since Israel's success in the Bekaa Valley, world interest in the development and acquisition of UAV has continued to increase. Israel has developed a new generation UAV. Several European countries have ongoing developmental programs of their own, and have shown interest in "foreign" systems. A driving factor behind current European interest in UAVs is to provide

target acquisition for their multiple launch rocket systems (MLRS).17 Other countries have also shown interest in obtaining UAVs. The USSR has maintained a high interest in the development of UAVs. Existence of a Soviet-built UR-1 reconnaissance/ELINT drone surfaced when one was shot down near the Israel/Lebanon border in June 1985. In addition, a Soviet mini-RPV, designated as the DR-3, was first used in the conflict over Lebanon as early as 1984.18

U. S. interest in UAVs has continued over the years at an irregular pace. Following U.S. involvement in Vietnam, UAV research and development slowed. The main Army project, which began in 1974, was the Aquila program. The Army's efforts to acquire The Aquila faltered with a number of developmental problems. The inabililty to match evolving technology to changing service requirements was the major reason for the delays. In addition, the Aquila performed poorly in tests conducted at Ft. Hood, Texas, between November 1986 and March 1987. This and increased congressional interest spelled the end for the Aquila and a major change in the UAV acquisition process.19

The Aquila program ran until 1987 before it was cancelled, cost over one billion dollars, and was the

major impetus behind Congress finally mandating a joint UAV effort within all of the Department of Defense.20 In fiscal year (FY) 1988, Congress cut funds to all single service RPV acquisition programs and created the Joint UAV Program Office (JPO) in the office of the Secretary of Defense with the intent of instilling inter-service cooperation and eliminating duplication.21

The JPO's master plan defines a family of RPV's consisting of four types to meet the requirements specified by the services. They are the close range, short range, medium range, and endurance.22 Analysis in this monograph, addressing the tactical level of war at division and below, will mainly address the close and short range systems. The basic differences in concept between the close range and short range systems are shown in table 1.

TABLE 1: DOD CLOSE AND SHORT RANGE UAV REQUIREMENTS 23

	CLOSE RANGE	SHORT RANGE
Required by	All Services	All Services
Operational Capabilities	Reconnaissance Surveillance Target Acquisition Target Spotting Disruption and Deception	Reconnaissance Surveillance Target Acquisition Target Spotting Disruption and Deception Meteorological NBC Reconnaissance
Launch and Recovery	Land/Sea	Land/Sea
Radius of Action	to 30 km	to 150 km
Loiter	1-6 hours	5-12 hours
Information Timeliness	< 1 minute	< 1 minute to 3 hrs
Sensor Types	Imaging Jamming	Imaging Jamming Designator Comm Relay Meteorological NBC
Air Vehicle	Remote and Tethered	Remote
Ground Station	Manpacked/HMMWV	Vehicle and Ship with Remote
Crew Size	2	To Be Determined

III. Needs of the Tactical Commander

> Tactical commanders focus their intelligence operations within both their areas of operation and their larger area of interest. The IPB should start well before combat operations begin. It is a continuous, integrated, and comprehensive analysis of the effects of enemy capabilities, terrain, and weather on operations. The IPB should extend throughout a unit's entire area of interest, focusing on specific units or NAI designated by the commander. It includes forward and rear areas as well as adjacent terrain.24

Intelligence provided by air reconnaissance can be instrumental in the intelligence preparation of the battlefield process. The intelligence data base used in the IPB process is continually being updated by intelligence coming from various collection means including air reconnaissance. The data base will include information on the units area of operation (AO) and area of interest.25 During mission planning, IPB plays a crucial role in integrating the intelligence operation with the commander's scheme of fire and maneuver. From this will come the reconnaissance and surveillance (R&S) plan.26 Possible targets for air reconnaissance will come from this plan. In addition, "terrain analysis, integrated with knowledge of how a

specific foe would like to fight, can provide likely areas on the battlefield where intelligence operations, including air reconnaissance assets, can be focused to determine enemy courses of action."27

Determining the enemy intent is critical since successful execution of the friendly battle plan relies heavily on determining the actual enemy plan and how it differs from the probable courses of enemy action developed by the staff. Properly positioned assets will provide the priority intelligence requirements (PIRs) and information requirements (IRs) the commander needs to make the best decisions as the battle unfolds.28

Properly positioned intelligence assets also contribute to the deep and rear battle as well as the close battle. Deep battle effectiveness is increased with overhead target acquisition, surveillance, and adjustment of fires. Tactical doctrine embodied in AirLand Battle and NATO Follow-on Forces Attack (FOFA) emphasizes deep penetration and attack of enemy forces before they become a factor in the close battle. UAVs offer the capability to detect targets at long range for engagement by ground systems. It also offers the

ability to monitor targets and have then engaged without the risk to manned aircraft.29

There will also be a need for UAVs in the rear area on today's nonlinear battlefield described in AirLand Battle doctrine. Quick response from reconnaissance assets will aid the essential defensive nature of the rear area by providing early detection for massing fires on rear threats.30

To help meet the challenge of fighting on the modern, fluid battlefield described in AirLand Battle doctrine, the Army has specified the intelligence requirements of the commander at each level in the UAV master plan. The area of responsibility attributed to each level of command is roughly equivalent to the area of operation and that part of the area of interest lying in sector. Information from adjacent and rear areas of interest will remain a coordination responsibility with other units. Events within this area of responsibility impact directly on the battle the tactical commander is fighting.

At the battalion level the commander needs three capabilities offered by UAV's. The first is for reconnaissance to obtain information and find targets within his area of responsibility. This area is

loosely defined as his area of operation plus an area extending approximately 15 km past the forward line of own troops (FLOT). Second, the battalion commander has a requirement for surveillance within his entire area of responsibility. Third, the battalion commander needs target acquisition capabililty to fight his battle.31 These three elements, together, comprise the reconnaissance, surveillance, and target acquisition (RSTA) function as part of the unit intelligence and electronic warfare (IEW) operation.

The brigade commander has similar RTSA support requirements to execute his plan. He has the additional need of target spotting for adjustment of fires onto targets. His area of responsibility for targets extends beyond the FLOT to a distance of approximately 30 km.32

The division commander requires the four operational capabilities already addressed. In addition, he needs capabilities for improved command and control, meteorological data collection, NBC detection, and disruption and deception. His information must be near real-time on targets identified as high value and no more than two hours old on other information. His area of responsibility for

reconnaissance and surveillance extends to approximately 90 km beyond the FLOT.33

Thus, the total identified requirements that UAVs must be able to provide to the three tactical levels of division, brigade, and battalion are reconnaissance, surveillance, target acquisition, target spotting, command and control, meteorological data collection, NBC detection, and disruption and deception. There would be no urgent requirement for a UAV system to provide tactical air reconnaissance if current systems were meeting the needs of the ground commander. However, a look at systems available at the battalion, brigade, and division level reveals some significant shortfalls.

At the battalion level, organic IEW resources are limited to ground units which can see out to about 10 km. The brigade has no organic assets to see farther than the battalion unless they have an OPCON aviation unit from division.34 Even then, the aviation unit's other missions will limit how much intelligence they can provide to the brigade collection effort.

The division is the first unit that has organic assets for an integrated intelligence collection capability. It is also the first level where airborne

assets complement the other collection capabilities. In the division, the combat aviation brigade has a QUICKFIX flight platoon that operates OPCON to the military intelligence (MI) battalion. (In the air assault division, the QUICKFIX flight platoon is organic to the MI battalion.)35 This platoon provides a standoff capability for communications intelligence, direction finding, and jamming support to the division. However, no photo capability is available, and direct overflight of the target or target area is not normally accomplished. Also, the target must be within line of sight for the system to be effective. Thus, targets in defiles or behind hills remain almost invisible, and the 50 km range capability of the standoff systems is significantly reduced.36

> Long-range surveillance operations significantly enhance the IEW system in providing current intelligence to tactical commanders as to threat formations within their respective areas of operations and interest.37

The long-range surveillance detachment is another division asset with the capability to gather intelligence to a planning range of 50 km.38 However, there are some limitations in their use. One is the

effort it takes and the risks associated with inserting these units behind enemy lines. Another limitation is their flexibility to move to other areas when the battlefield requirements change. Finally, these long-range surveillance units are hard to resupply and retrieve. UAVs have none of these limitations.

The capability of the division to "see deep" becomes significant when the division is augmented by the corps. The corps military intelligence (MI) brigade offers the first capability for aerial photography and airborne radar to detect targets. Corps ground-based systems ranges are not increased except for the range capability of the long-range surveillance unit. However, the collection systems that are on airborne platforms provide a significant increase in range and capabilities over the division level assets.39 The division depends on corps or higher assets for its air reconnaissance support and most of this support comes from the Air Force. Information obtained by the RF-4, the primary Air Force tactical air reconnaissance aircraft, is a valuable source of information for the tactical ground commander.

IV. Gaps in the Current System

There is a significant lack of resources to obtain tactical air reconnaissance at the tactical level. By comparing the range of organic intelligence gathering assets at each level to the area of interest of the commander we see a gap in the intelligence collection picture. The range of battalion assets is about 10 km while the specified area of responsibility for the commander has been estimated to be 15 km. The range of brigade assets is the same but the commander's area of responsibility is out to 30 km. Likewise, the range of division assets is about 50 km, but the commander's area of responsibility extends to 90 km beyond the FLOT. This would not be significant if corps assets could augment lower level resources to fill the gap. However, the corps does not have all the assets required to do this, and the corps may be more interested in using its assets to look even deeper beyond the FLOT to cover as much of its area of responsibility as possible.

In addition to increased range, each higher level incurs a slower turn-around time between information request and receipt. Thus, time is another factor

affecting the intelligence collection picture. Time is especially critical when the unit must rely on outside sources for tactical air reconnaissance. The battalion commander needs immediate responsiviness from intelligence to find and strike targets. The brigade commander needs near real-time information and the division commander needs near real-time information on designated high value targets, and less than two hours response time on other targets.40 Current systems are not capable of meeting these time requirements.

The Air Force is attempting to reduce the turn time on information it gains through tactical air reconnaissance. The current time of about three hours from tactical reconnaissance tasking until photos are analyzed is not always sufficient for the modern battlefield. The world of electro-optics provides the potential to change all this. The Advanced Tactical Air Reconnaissance System (ATARS) program, managed by the Air Force, will use mainly off-the-shelf systems to equip aircraft with the capability for day/night, real-time data link to ground exploitation stations. However, full production of the system is not expected until 1996.41

The delay in receiving these needed intelligence-gathering systems could have serious consequences. This can be demonstrated by an incident that happened to the U.S. Navy. Navy interest in UAV acquisition began after some glaring deficiencies surfaced in late 1983.

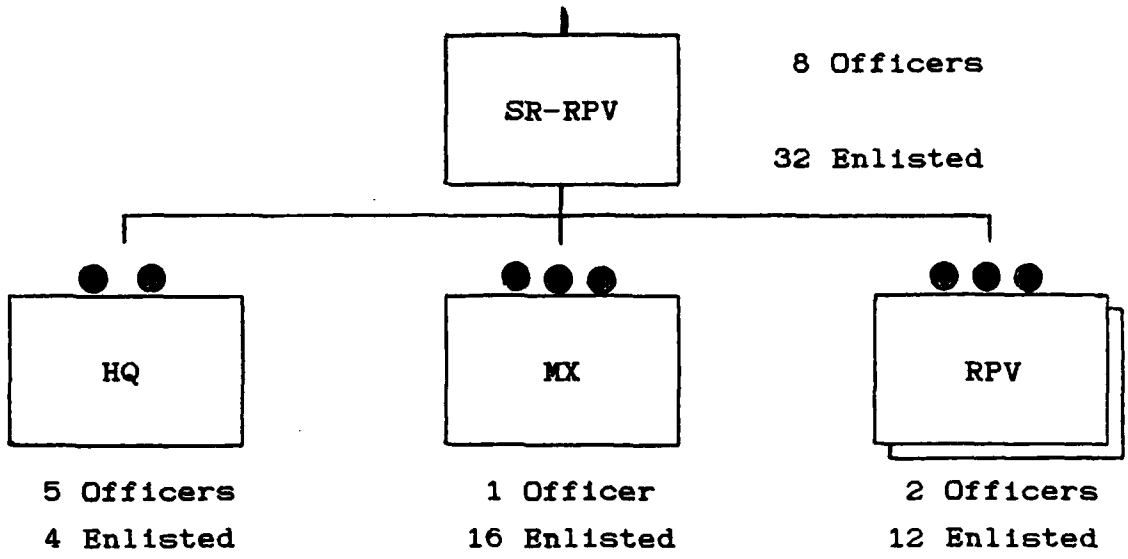
> On December 4, 1983 the danger of failing to incorporate an RPV capability into a total strike plan was driven home to the U. S. Navy. It was on this day that the Navy attacked SAM sites in Lebanon at a cost of three aircraft, one pilot, and a loss of confidence in U. S. ability to project power in the region. Ten days later, the 16 inch guns of the New Jersey opened up against Syrian AAA postition and the USN found that it had no means to correct that fire, other than by risking an expensive F-14A with a camera pod.42

Within six months the Marine Corps had activated the 2nd RPV Platoon at Camp Lejeune, North Carolina, using one of the Israeli systems that had been so successful in the Bekaa Valley.43 In addition, the Navy developed the short range UAV for shipboard operations. That system was deployed aboard the USS Iowa in 1986.44

The Marines added a second platoon to form an RPV company designed to support each Marine Air Ground Task Force (MAGTAF) with day/night operations. It is identified by doctrine as an "organic ground asset," but supports other components of the MAGTAF such as infantry, artillery, aviation, intelligence, communications, and rear area security.45 The organizational structure is shown in Figure 1. During operation, the RPV unit commander receives and coordinates support requests with interested staff officers including the Air Liaison Officer (ALO), the Intelligence Officer (G-2), the Operations Officer (G-3), and the fire support coordinator. He then prioritizes missions according to the commander's guidance.46

In addition to the practical lessons learned by the Navy and Marines, the two AirLand Battle tenets of depth and synchronization imply a need for "adequate" reconnaissance on the modern battlefield. "Adequate" reconnaissance must be available to help "beyond areas of immediate concern" to achieve both "momentum in the attack" and "elasticity in the defense."47

FIGURE 1: MARINE RPV CO STRUCTURE 48



> Depth is the extension of operations in space, time, and resources. Through the use of depth, a commander obtains the necessary space to maneuver effectively; the necessary time to plan, arrange, and execute operations; and the necessary resources to win. Momentum in the attack and elasticity in the defense derive from depth.49

> Synchronization is the arrangement of battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point.50

The successful tactical commander in AirLand Battle must also synchronize all aspects of the

battlefield. While this implies concentration of forces at the decisive time and place, it also includes the synergistic effect caused by events separated in time and space. Here, accurate and timely intelligence can be helpful.

The tactical commander must use intelligence to develop a synchronized plan. During the battle, targets must be detected, identified, and then destroyed or monitored. A responsive tactical air reconnaissance system would provide the commander with valuable information to help synchronize the battle to sufficient tactical depth.

The requirements of a UAV system that will fill the air reconnaissance gap at the tactical level are survivability, responsiveness, capability of continuous operations, and adequate command and control. The remainder of this section will discuss these four necessary attributes of a viable UAV system.

The first requirement for a UAV system must be its ability to survive a high threat environment. The modern battlefield presents many threats, both on the ground and in the air. This has led some to question the current practice of sending manned aircraft on many of the reconnaissance missions to the tactical depth of

the battlefield. As the number and capabilities of the threat to manned systems continues to increase, so the questions about their employment.

In a high threat environment, penetrating the forward line of own troops (FLOT) is a major effort that must be successfully accomplished on a reconnaissance mission. Some standoff capability can be used for targets near the FLOT, but the line-of-sight problems associated with other intelligence gathering assets becomes a factor. In addition, the Air Force's RF-4 reconnaissance aircraft will try to cross the FLOT within a larger formation of aircraft. Combining a mass of aircraft with an intensive joint suppression of enemy air defenses (J-SEAD) operation greatly increases the survival rate. Chances of successful penetration is reduced when the RF-4s are not massed within a package. J-SEAD remains a requirement.

A UAV system would be survivable on the modern battlefield. Modern technology combines a small size with composite materials into a system with a very low radar cross-section. When the enemy radar systems have difficulty detecting the UAV, radar-guided weapons systems cannot be fired at it. Tests have shown that

small UAVs falling into the close range category of the UAV master plan are nearly undetectable by most weapons systems radars.51

Another means to detect UAVs is through their infrared radiation (IR) signature. However, the engines on close and short range systems are small enough that they emit a small hear/IR source which most current IR detectors cannot "see".52

Also, most of the UAVs currently under development are very quiet. If radars and IR detectors cannot acquire a UAV, then the next threat is from weapons systems that are optically aimed. Close range UAVs designed to operate between 1,000 and 5,000 feet would be in this threat envelope.53 However, if not radar detected, or audibly detected, chances are greatly reduced of being able to visually acquire the UAV. Engaging the enemy with a relatively low cost, unmanned system that is hard to detect would reduce its target value over manned systems in the eyes of the enemy.

These characteristics give the UAV an advantage over current manned systems. However, critics maintain that manned systems using the same "stealth" technology would be even more effective. This may be true, but a commander is much less likely to send a manned aircraft

into such a lethal environment, especially after a few manned systems have been shot down. Also, a manned system, if it remained under Air Force control, would exhibit the same problem of responsivenss as the current system and will be discussed later in this section.

The psychological impact of sending manned aircraft into such a lethal environment may be significant. Having the option of using either a manned or unmanned system would give the commander greater flexibility. The tactical reconnaissance aircraft is a critical asset with two important components. First, the replacement time and cost of the system may severly restrict its use in a high threat environment. Second, the pilot is an even more critical element. It currently takes about one and one half years to train a pilot to the basic skill level in an RF-4. Even then he must receive much additional training to be capable of flying a tactical reconnaissance mission in a high threat environment.

Another threat to any intelligence and electronic warfare system's survivability is the enemy's electronic warfare capabilities, in the form of deception and jamming. Current technology provides jam resistant data link systems that reduce, but don't

completely counter this threat. However, close range systems have even been designed that are controlled by a fiber-optic wire that unwinds as the UAV flys forward. Information is down-linked through the wire and cannot be jammed. The main restriction on this system is its limited range of about 18 km.54

The second requirement for a UAV system is responsiveness. We have already seen that the need for quick turn-around time at brigade and battalion level precludes effective support from many Air Force tactical air reconnaissance missions. Even at the division level, there is only target nomination for Air Force tactical air reconnaissance that is forwarded to theater through the corps. Corps support does not provide adequate coverage both in numbers of systems and the effective ranges that systems can operate. The division commander needs his own assets that can be assigned to specific roles based on mission priority. This decentralized control equates to responsiveness of the system to meet the tactical commander's needs.

A third requirement for any system to fight AirLand Battle is the capability for continuous operations. Current UAV systems are capable of operating both day and night. Daytime components

include TV cameras, IR sensors, laser designators, and radars, to include a synthetic aperture radar that will tie in with new battlefield management systems currently being developed by the Army and Air Force. Other sensors can be carried to pick up enemy radio/electronic emissions and detect NBC agents. The system can also operate as a radio relay giving extended range to current ground based systems.

As part of the environment that accompanies continuous operations, night and weather place increased demands on all warfighting systems. Night reduces the normal TV capability, but low-light TV cameras may still be effective. On the positive side, survivability of the UAV increases at night due to visual acquisition problems of the enemy. Weather does pose some additional restrictions. Problems of flying in moisture, especially in icing conditions, must be overcome. However, these problems are more restrictive on manned systems, and progress has been made in this area on current UAVs under development. Also, the requirement for corps aerial exploitation assets to operate from an all-weather airport would not apply to UAVs.

The final requirement of a UAV system is that it must allow for adequate command and control (C2) at the appropriate level within the Army force structure. The corps requires the short range UAV system, but it must also incorporate the medium range and endurance UAVs as well. Having the UAV unit only at the corps level would be a mistake. It would lead to overcentralization of control and take away the flexibility from lower level tactical commanders.

The division is the best level to have an organic UAV unit to meet the needs of lower level tactical commanders. A UAV company with a platoon of short range UAVs and one or two platoons of close range UAVs would provide a significant combat multiplier. Sections from the UAV company could then be given direct support missions to other units or remain in general support of the division.

Command lines within the division must still be worked out. There are three organizations within the division that would have an affiliation with some of the roles the UAV provides: division artillery, the combat aviation brigade, and the military intelligence battalion.

One of the primary roles for the UAV is support of the artillery target acquisition capability. In fact, the original concept for the Aquila was to assign a battery of four sections, each with five UAVs, to each division artillery battalion.55 Some artillery publications still contain references to UAVs. However, there would be no clear lines of command and control for the other roles of the UAV units if they were an artillery asset.

Likewise, the MI battalion needs the capabilities offered by UAVs. They especially need the information gained through UAVs for the collection, management, and dissemination (CM&D) section. A remote receiving station for airborne UAVs should be located there.

Also, the aviation brigade has ties to the roles the UAV performs. A UAV could locate targets for helicopter attack and use a laser designator to mark targets for Hellfire. In addition, airspace command and control issues could be worked more easily through the established system inherent in the aviation brigade's structure. Still, neither of these organizations has the capability to direct the other missions the UAV can offer to the division.

The best solution is to have a UAV company as a division unit. The sections would be given direct support missions to any other unit needing the specific capabilities the UAV can offer based on a commander's/G-3's prioritization from the staff planning process. Sections not used in direct support roles would be retained by the division for general support.

There is currently a limitation on the amount of support a UAV section can provide. Marine Corps operational systems capabilities are limited to a maximum of two UAVs airborne at one time. One can be under direct control and one having been pre-programmed.56 However, new systems being developed have "addressed" control messages so more than one system can be under the direct control of a single ground control station.57

V. Final Issues

Several isues will have to be resolved to implement a UAV system responsive to the needs of the tactical commander. One of these issues is the cost of acquiring UAVs, especially in the shadow of expected cuts in the military budget. Total cost on some of the

close range systems is just under one million dollars.58 The system includes the flying vehicle and the necessary ground control assets to complete the system. The actual cost to add vehicles is not that great since over 75 per cent of the total cost is for the sensors and ground equipment.59 Short range systems would be considerably more expensive to purchase, but historically, the unmanned systems' costs run about one tenth the cost of manned systems.60 The cost issue will continue to influence the acquisition process and may significantly string out the time until UAV units are part of the force structure at the tactical level.

Another area that may delay the acquisition of UAVs is the problems associated with joint development. When Congress mandated the joint development of UAVs, they left the development of sensors, data link, and ground processing stations for the Unmanned Air Reconnaissance System under ATARS - An Air Force system.61 This gives the Air Force a great deal of influence in which sensor components receive development and acquisition priority, and the close range UAV needed by the Army is low priority for the Air Force.

Another joint issue is the conflict in roles and missions between the Army and Air Force. The memorandum of understanding between the Army and the early Air Force in 1952 limited organic Army aviation to roles that ..."would not duplicate the functions of the U.S. Air Force in providing the Army...close combat support, assault transport and other troop carrier airlift, aerial photography, tactical reconnaissance..."62 Just as a new memorandum of understanding was reached on the issue of close air support, the issue of tactical air reconnaissance will have to be relooked.

VI. Conclusions

The intelligence requirements to fight the tactical fight as part of AirLand Battle will become more and more critical as technology continues to develop. The UAV has proven it can be a valuble asset in gaining vital intelligence needed by the ground commander. The classic example of the integrated use of UAVs was demonstrated by Israel in Operation Peace for Galilee in 1982. The initiative was gained and maintained throughout the operation with a significant contribution from UAVs. Since then, many countries

have been actively seeking to develop and acquire UAV systems.

The U.S. Navy felt the restrictions imposed by lack of an unmanned reconnaissance system in Lebanon. They were confronted by a situation that required exposing a manned system where a UAV could have easily been substituted. Since then the Navy has deployed operational UAVs on its battleships and the Marine Corps has UAV companies assigned to each MAGTF.

The Army has fallen behind in its search for an operational UAV as a result of the Aquila failure. The current joint acquisition program master plan specifies requirements for a family of UAVs. Within that family, the close range and short range systems could greatly increase the intelligence gathering capabilities of tactical units. These UAVs would be survivable on the modern battlefield, responsive to the tactical commander, and allow for continuous operations.

The Army needs to obtain operational UAV companies for each of its divisions. They would greatly increase the capabilities of the division to conduct AirLand Battle. Current systems do not provide an adequate source of all the intelligence needed by the tactical commander. He needs better information in a more

timely manner than current systems provide. The UAV systems currently being developed would fill the existing gaps. Both the short and close range systems need to become operational in Army divisions.

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